MST121

Assignment Booklet II 2006B

Contents

You are advised to read through this entire document before commencing work on the assignments, as it contains important information about submission.

This booklet contains the final two assignments for MST121: TMA 04 and CMA 42. We hope that these two assignments will help you to consolidate your year's work on the course. It is **not possible to substitute your mark for either TMA 04 or CMA 42**. In order to pass the course, you must achieve a **weighted average of 40% over all the assignments for the course**, and achieve at least the **threshold of 30% on TMA 04**. (Substitution is explained in the undergraduate *Assessment Handbook*, and the weightings for assignments are given in the *Course Guide* and at the bottom of the *Study Calendar*.)

Advice and information about submission of assignments

Your tutor is **not authorised to give any extensions for TMA 04**. If you have **serious problems** in meeting the deadline, then read the ***Important information for TMA 04 and CMA 42*** on page 16 of this booklet.

The work you submit must be your own and not copied from, or provided by, others. There is further information on plagiarism in the *Assessment Handbook*.

You are advised to keep a copy of each assignment in case of loss in the mail. Remember to fill in your PI number and the assignment number, and to sign the plagiarism statement. You should allow sufficient time in the post for the assignment to arrive by the cut-off date. **Check that the postage is sufficient.** You are advised to obtain a certificate of posting for each of these two assignments.

Send your answers to TMA 04 to **your tutor**, together with an appropriately completed TMA form (PT3).

Your completed CMA form for CMA 42 should be posted in the envelope provided.

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Study advice

TMA 04 and CMA 42 cover the whole course. You should start your revision of the course, and work towards TMA 04 and CMA 42 as soon as you have finished studying Block D. It is possible to submit TMA 04 and CMA 42, and to pass the course, even if you have not finished working through the course material or completed all of the other assignments. Even if you do not finish TMA 04 and CMA 42, send in what you have done to arrive by the respective cut-off dates, as you may well pass the course. Note that CMA 42 has a lower weighting than TMA 04, and no threshold.

Please submit your TMA 04 in dark ink (whether hand-written or word-processed) as it may be photocopied for monitoring purposes.

Points to note when preparing solutions to TMA questions

- Contact your tutor if the meaning of any part of a question does not seem clear.
- Your solutions should not involve the use of Mathcad, except in those parts of questions where this is explicitly required or suggested.
- Where a question involves mathematical calculation, show all your working. You may not receive full marks for a correct final answer that is not supported by working. You may receive some marks for working even if your final answer is incorrect or your solution is incomplete.
- Whenever you perform a calculation using a numerical answer found earlier, you should use the full-calculator-accuracy version of the earlier answer to avoid rounding errors.
- Number all of your pages, including any computer printouts.
- Indicate in each solution the page numbers of any computer printouts associated with that solution.

This assignment covers *the whole course.*

You should submit solutions to up to *three* out of the four questions in TMA 04. Each question will be marked out of 25, and your total mark (out of 75) for the three questions will be scaled up to give a mark out of 100. One of the requirements for passing the course is that you must obtain a final mark of at least 30 out of 100 (23 out of 75) for this assignment. The marks allocated to the parts of each question are indicated in brackets in the margin. Your overall score for this TMA will be calculated from the sum of your marks for only three questions. If you submit solutions to four questions, your tutor will mark the first three.

Question 1 – 25 marks

In this question, positions are given with reference to a Cartesian coordinate system whose x- and y-axes point due east and due north, respectively. Distance and time are measured in metres and seconds, respectively.

(a) A light aeroplane flies horizontally at a steady speed in a straight line above horizontal ground; its position at time t is $(30t - 300, 10t + 500)$. On the ground there are two lookouts, A and B, at positions $(7100, 2800)$ and $(125\,700, 42\,500)$, respectively.

(i) Write down an expression in terms of t for the square of the horizontal distance between the aeroplane and lookout A at time t, and simplify your answer. [3]

(ii) Use your answer to part (a)(i) and the technique of completing the square to find the closest horizontal distance as the aeroplane passes lookout A, correct to the nearest ten metres, and the time at which this closest distance occurs. [5]

(iii) Show that the aeroplane flies directly over lookout B, and state in minutes the time taken to reach lookout B, assuming that the aeroplane starts at time $t = 0$. [4]

(iv) Find the speed of the aeroplane, in metres per second to one decimal place, and its direction of flight, as a bearing, correct to the nearest degree. [3]

(b) On a second flight, the aeroplane starts from the same position as in part (a), namely $(-300, 500)$, and is pointed in the direction N 70°E. Its speed in still air is $30\,\mathrm{m\,s^{-1}}$, but it flies in a wind of speed $12\,\mathrm{m\,s^{-1}}$ *from* the direction S 10°E. Take

$\mathbf{v}_\mathrm{a}$ to be the velocity of the aeroplane in still air,
$\mathbf{v}_\mathrm{w}$ to be the velocity of the wind,
$\mathbf{v}$ to be the resultant velocity of the aeroplane.

(i) Draw a diagram illustrating the three velocities. Your diagram should be in the form of a triangle illustrating how one velocity vector is the sum of the other two. Label the vectors clearly, and calculate and mark the angle between $\mathbf{v}_\mathrm{a}$ and $\mathbf{v}_\mathrm{w}$. [3]

(ii) Use the triangle, and appropriate rules involving trigonometry, to calculate the overall speed of the aeroplane, in metres per second to one decimal place, and its direction of flight, as a bearing, correct to the nearest degree.

(No marks will be given for using component form for vectors.) [7]

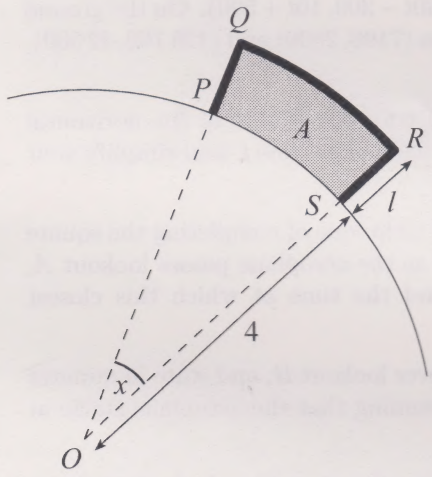
Question 2 – 25 marks

This question requires the use of Mathcad throughout, except in part (a). For each of parts (b)–(d) you should provide an appropriate printout, though a printout on one page may cover your answers to several parts. Annotate your printouts with Mathcad text or handwriting, or reference them from a separate sheet, in order to explain clearly what you have done and what your conclusions are.

A flexible wire $PQRS$, of total length 4 metres, is bent into the planar shape shown in the diagram below. (Note that the arc PS is not part of the wire.) The end-segments PQ and RS of the wire are each straight and have equal length l metres, while the middle segment QR forms a circular arc. The tangent to the arc QR at Q is perpendicular to QP, while the tangent to the arc QR at R is perpendicular to RS.

The ends P, S of the wire are placed against a disc of radius 4 metres with centre at O, as shown below. The arc QR forms part of a circle with centre at O and subtends an angle x (in radians) at O.

This question concerns the area A enclosed between the wire and the edge of the disc, which is shown shaded below.



(a) *Do not use Mathcad in this part of the question.*

(i) Express the length of the wire $PQRS$ in terms of l and x. Hence express l in terms of x. [2]

(ii) Hence show that the area A can be expressed by $A = f(x)$, where

$$f(x) = \frac{8x(1-x)(5+x)}{(2+x)^2}.$$ [3]

(iii) Explain why it is reasonable to choose $[0, 1]$ as the domain for $f(x)$. [1]

(b) (i) Plot the graph of the function $f(x)$. You may either use the Mathcad graph plotter file (121A3-04) or plot the graph in a new worksheet of your own. Your graph should cover the interval $[0, 1]$ in the x-direction and $[0, 2]$ in the y-direction. [3]

(ii) By using the 'Trace' facility (and also, if you wish, the 'Zoom' facility), estimate to 2 decimal places the coordinates of the point on this graph at which $y = f(x)$ takes its maximum value. [2]

(iii) On the same graph, plot the line $y = 1$. Using the 'Trace' facility, estimate to 2 decimal places both solutions of the equation $f(x) = 1$. (These solutions give the values of x for which the shaded area is $1\,\text{m}^2$.) [2]

(c) Each of the following recurrence relations has the property that if a sequence generated by the recurrence relation converges to a limit in the interval $[0, 1]$, then that limit must be a solution of the equation $f(x) = 1$. (*You are not asked to show this.*)

$$\mathbf{A}: \quad x_{n+1} = \frac{(2 + x_n)^2}{8(1 - x_n)(5 + x_n)} \qquad (n = 0, 1, 2, \ldots)$$

$$\mathbf{B}: \quad x_{n+1} = \frac{2}{9 - \sqrt{8(6 - x_n)}} \qquad (n = 0, 1, 2, \ldots)$$

(i) For each of these recurrence relations, generate the sequence with starting value $x_0 = 0.8$, and tabulate your results to 6 decimal places. Which sequence converges more rapidly? (That is, which sequence gives an estimate with specified accuracy for its limit with the smaller value of n?) [4]

(ii) Use your tabulated results to write down the solutions of the equation $f(x) = 1$ to 6 decimal places. [2]

(d) This part of the question concerns finding the maximum value of the function $f(x)$, as estimated in part (b)(ii), and hence the maximum possible value of the shaded area A.

(i) *You may need to put $x := x$ in your worksheet before answering this part.*

Use symbolic differentiation and the 'simplify' keyword to find an expression for the derivative $f'(x)$. [3]

(ii) The maximum value of $f(x)$ occurs where $f'(x) = 0$. Use a Solve block to solve the equation $f'(x) = 0$ for x, giving your answer to 6 decimal places. [2]

(iii) Calculate the corresponding maximum possible value of the area A, giving your answer to 4 decimal places. [1]

Question 3 – 25 marks

(a) (i) Use the Quotient Rule to show that the function

$$f(x) = \frac{20 + 16x - x^2}{4 + x^2}$$

has derivative

$$f'(x) = \frac{16(4 - 3x - x^2)}{(4 + x^2)^2}.$$ [3]

(ii) Find any stationary points of the function $f(x)$ defined in part (a)(i), and use the First Derivative Test to classify each stationary point as a local maximum or a local minimum of $f(x)$. [4]

(iii) Specify the maximum and minimum values of the function $f(x)$ on the interval $[-6, 2]$. [3]

(iv) Using your answer to part (a)(i), find the area bounded by the graph of

$$y = \frac{8(4 + x)(1 - x)}{(4 + x^2)^2}$$

and by the x-axis. [3]

(b) (i) Use the Composite Rule to differentiate the function

$$g(x) = \sqrt{1 + x^2}.$$ [4]

(ii) Use the Composite Rule and your answer to part (b)(i) to show that the function

$$h(x) = \ln\left(x + \sqrt{1 + x^2}\right)$$

has derivative

$$h'(x) = \frac{1}{\sqrt{1 + x^2}}.$$ [3]

(iii) Using your answer to part (b)(ii), or otherwise, solve the initial-value problem

$$\frac{dy}{dx} = \frac{y}{\sqrt{1 + x^2}} \quad (y > 0), \qquad y = 2 \text{ when } x = 0,$$

giving the solution in explicit form. [5]

Question 4 – 25 marks

This question requires the use of OUStats.

The file BUILD.OUS contains the heights, in inches (abbreviated to 'in'), and the weights, in pounds (abbreviated to 'lb'), of 98 students following an elementary statistics course in the USA. The heights and weights of the male students are in 'MHt' and 'MWt', respectively; the heights and weights of the female students are in 'FHt' and 'FWt', respectively.

(a) It is required to obtain a histogram for the weights of female students. Assume that the weights have been measured to the nearest 1 lb.

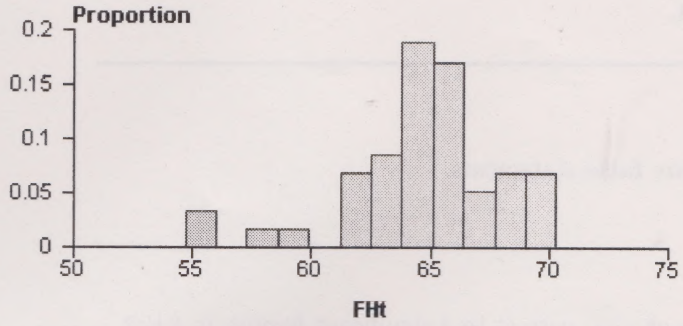
(i) What is the weight of the lightest female in the sample? [1]

(ii) State the first interval starting value that it would be most appropriate to use in order to obtain a histogram of the female weights, so that the lightest female weight is included in the first group. [1]

(iii) Obtain a printout of a *histogram* of the female weights, using the first interval starting value for weights that you suggested in part (a)(ii) and an interval width of 10 lb. Give one reason why a normal distribution might not be a suitable model for the female students' weights. [4]

(iv) On a separate diagram, sketch a curve which you think might be a suitable model for the variation in weights of female students, marking your scale clearly on the x-axis. [1]

(v) A histogram of the sample of female heights is given below.



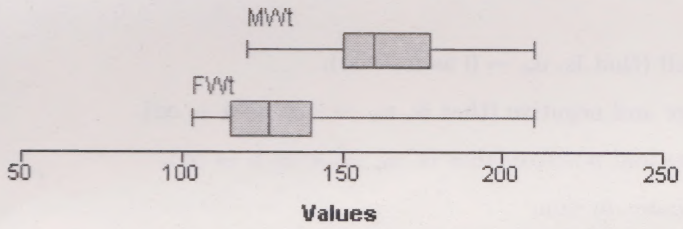
Give one reason why a normal distribution might not be a suitable model for female heights. [2]

(vi) Compare the histogram for the weights of female students, obtained in part (a)(iii), with the histogram for the heights of female students in part (a)(v). Identify the main difference between the shapes of the two histograms. Briefly explain why the shapes of the two histograms might have been expected to be more similar. [3]

(b) In this part of the question you are asked to compare the difference between the variation in heights for males and females with the difference between the variation in weights for males and females.

(i) Use OUStats to produce boxplots of the sample of male heights ('MHt') and female heights ('FHt'), putting both boxplots on a single diagram. [2]

(ii) Boxplots of male and female weights ('MWt' and 'FWt') are given below.



Compare these boxplots with the boxplots of male and female heights that you produced in part (b)(i). Comment on what all these boxplots together tell you about the spread of heights for males and females, and the spread of weights for males and females. [3]

(c) In this part of the question you are asked to consider the relationship between the height and weight of male students.

(i) Obtain a printout of a scatterplot of the heights ('MHt') and weights ('MWt') of male students, using MHt as the explanatory variable. Describe briefly any pattern that you observe in the plot. [4]

(ii) Obtain the equation of the regression line of MWt on MHt, and hence write down an equation which may be used to model the relationship between height and weight for the male students. [2]

(iii) Using the model from part (c)(ii), estimate the weight of the shortest male student in the sample, whose height is 56 in. [2]

This assignment covers the whole course.

Questions 1 to 7 are on Block A.

Question 1

Choose the TWO options that are **false** statements.

Options

A $(\sqrt[3]{4})^6 = 16$

B The decimal representation of $\sqrt{17}$, correct to 4 significant figures, is 4.123.

C $\dfrac{a^6}{a^3 \times a^4} = \left(\dfrac{1}{a}\right)^2 \quad (a \text{ in } \mathbb{R},\ a \neq 0, 1)$

D $\sqrt{2}$ cannot be expressed as a recurring decimal.

E $\left(\dfrac{1}{32}\right)^{-1/5} = 2$

F $(\sqrt[5]{3})^4 = 3^{5/4}$

Question 2

A sequence is defined by

$$u_n = 13 \times (-0.37)^n + 2.7 \quad (n = 1, 2, 3, \ldots).$$

Choose the option that describes the long-term behaviour of the sequence.

Options

A u_n becomes arbitrarily small (that is, $u_n \to 0$ as $n \to \infty$).

B u_n becomes arbitrarily large and negative (that is, $u_n \to -\infty$ as $n \to \infty$).

C u_n becomes arbitrarily large and positive (that is, $u_n \to \infty$ as $n \to \infty$).

D u_n is unbounded and alternates in sign.

E u_n approaches 2.7 (that is, $u_n \to 2.7$ as $n \to \infty$).

F u_n approaches 15.7 (that is, $u_n \to 15.7$ as $n \to \infty$).

Question 3

Choose the option that represents the equation of the line perpendicular to the line $6x + 5y = 3$, passing through the point $(-2, 3)$.

Options

A $5x + 6y = 8$ **B** $6x + 5y = 3$ **C** $5x - 6y = -28$

D $x - 6y = -20$ **E** $6x - 5y = -27$

Question 4

Choose the option that is the completed-square form for $x^2 + 4x - 7$.

Options

A $(x-2)^2 - 11$ **B** $(x+2)^2 - 11$ **C** $(x-4)^2 - 23$

D $(x+4)^2 - 23$ **E** $(x-6)^2 - 43$ **F** $(x+6)^2 - 43$

Question 5

Choose the option that gives the domain of the function

$$f(x) = \frac{1}{\sqrt{(3-x)(7+x)}}.$$

Options

A $\mathbb{R}$ **B** $(-7,-3)$ **C** $[3,\infty)$

D $(-\infty,-7]$ **E** $[-7,-3]$ **F** $(-7,3)$

Question 6

Choose the option that is a **true** statement.

Options

A $\dfrac{\arcsin x}{\arccos x} = \arctan x \quad (x \text{ in } (-1,1))$ **B** $\cos(\arccos \pi) = \pi$

C $\arccos(\frac{1}{6}\pi) = \frac{1}{2}\sqrt{3}$ **D** $\arctan(\cos \pi) = -\frac{1}{4}\pi$

E $\arctan(\tan(2\pi)) = 2\pi$ **F** $\arcsin x = \dfrac{1}{\sin x} \quad (x \text{ in } (0,1))$

Question 7

Choose the TWO options that are **false** statements.

Options

A $3\ln(2-x) = \dfrac{8}{x^3} \quad (x < 2,\ x \neq 0)$

B $\log_2\left(\frac{1}{4}(2^{3x})\right) = 3x - 2 \quad (x \text{ in } \mathbb{R})$

C $\ln\left(e^{2-x^3}\right) = 2 - x^3 \quad (x \text{ in } \mathbb{R})$

D $10^{3\log_{10} x} = x^3 \quad (x > 0)$

E $\ln\left(\dfrac{2x}{x^3-1}\right) = \ln 2 + \ln x - \ln(x^3-1) \quad (x > 1)$

F $\ln(5e^{-x}) = 5 - x \quad (x \text{ in } \mathbb{R})$

Questions 8 to 14 are on Block B.

Question 8

Choose the option that gives the value of $\sum_{i=65}^{110} (78 + 3i)$.

Options

A	7613	**B**	12 153	**C**	15 468	**D**	15 585
E	15 663	**F**	20 655	**G**	21 903	**H**	28 143

Question 9

The variation from year to year in a particular population can be modelled by an exponential model with annual proportionate growth rate 0.1343. The size of the population at the start of the initial year is 450.

Choose the TWO options that give, as predicted by the model,

(a) the population size after 7 years;

(b) the predicted number of years for the population size to reach at least 5000.

Options

A	958	**B**	1087	**C**	1233	**D**	3573
E	18	**F**	20	**G**	37	**H**	38

Question 10

Choose the THREE options that define sequences that do not converge.

Options

A $P_0 = 40, \quad P_{n+1} - P_n = 0.8P_n\left(1 - \dfrac{P_n}{200}\right) \quad (n = 0, 1, 2, \ldots)$

B $P_0 = 100, \quad P_{n+1} - P_n = 2.7P_n\left(1 - \dfrac{P_n}{750}\right) \quad (n = 0, 1, 2, \ldots)$

C $P_0 = 250, \quad P_{n+1} - P_n = 2.1P_n\left(1 - \dfrac{P_n}{400}\right) \quad (n = 0, 1, 2, \ldots)$

D $a_n = \dfrac{6 - n}{1 + 3n} \quad (n = 0, 1, 2, \ldots)$

E $a_n = \dfrac{3 + 8n^3}{1 + n^4} \quad (n = 0, 1, 2, \ldots)$

F $a_n = \dfrac{20}{50(0.4)^n} \quad (n = 0, 1, 2, \ldots)$

Question 11

The variation in a population is modelled by the recurrence relation

$$\begin{pmatrix} J_{n+1} \\ A_{n+1} \end{pmatrix} = \begin{pmatrix} 0.9249 & 0.0215 \\ 0.0661 & 0.9797 \end{pmatrix} \begin{pmatrix} J_n \\ A_n \end{pmatrix} + \begin{pmatrix} 0.011 \\ 0.035 \end{pmatrix},$$

where J_n and A_n are the sizes, in millions, of the subpopulations of juveniles and adults, respectively, n years after 1 January 2006. On that date there were 4.22 million juveniles and 17.19 million adults. Choose the option that gives the total population, in millions to two decimal places, predicted by the model for 1 January 2007.

Options

A 20.50 **B** 20.73 **C** 21.12 **D** 21.25

E 21.31 **F** 21.39 **G** 21.41 **H** 21.44

Question 12

Three forces (and no others) act upon an object, which remains at rest. The forces are represented by the vectors $\mathbf{P}$, $\mathbf{Q}$ and $\mathbf{R}$, where

$$\mathbf{P} = -6\mathbf{i} - 2\mathbf{j} \quad \text{and} \quad \mathbf{Q} = 3\mathbf{i} + 11\mathbf{j}.$$

Choose the TWO options that give the magnitude and direction of the vector $\mathbf{R}$, each to one decimal place.

Options

A Magnitude 9.5 **B** Magnitude 13.3

C Direction $-108.4°$ **D** Direction $-71.6°$

E Direction $-69.4°$ **F** Direction $-20.6°$

G Direction $69.4°$ **H** Direction $71.6°$

Question 13

The vector $\mathbf{a}$ has magnitude 4.7 and direction $-121°$, and the vector $\mathbf{b}$ has magnitude 2.5 and direction $38°$. Choose the option that gives the component form of the vector $2\mathbf{a} + 3\mathbf{b}$, to one decimal place.

Options

A $-4.8\mathbf{i} + 4.6\mathbf{j}$ **B** $-3.3\mathbf{i} - 9.7\mathbf{j}$ **C** $-2.8\mathbf{i} - 6.5\mathbf{j}$

D $0.9\mathbf{i} - 7.5\mathbf{j}$ **E** $1.1\mathbf{i} - 3.4\mathbf{j}$ **F** $1.1\mathbf{i} + 12.7\mathbf{j}$

G $10.8\mathbf{i} - 3.4\mathbf{j}$ **H** $10.8\mathbf{i} + 12.7\mathbf{j}$

Question 14

With respect to the usual convention for labelling a triangle (shown in Figure 3.1(a) on page 30 of *Chapter B3*), the triangle ABC has angles $A = 107°$ and $B = 42°$, and side length $a = 17$. Choose the option that gives the side length c of the triangle, to one decimal place.

Options

A 8.8 **B** 9.2 **C** 11.4 **D** 11.9

E 12.6 **F** 13.2 **G** 16.3 **H** 31.6

Questions 15 to 21 are on Block C.

Questions 15 and 16

The function f is given by

$$f(x) = \ln(1 + e^x).$$

By applying in turn the Composite and Quotient Rules, choose the option that gives an expression for each of the following.

15 $f'(x)$

16 $f''(x)$

Options for Questions 15 and 16

A $\dfrac{1+e^x}{e^x}$ **B** $-\dfrac{1}{e^x}$ **C** $\dfrac{e^x(e^x-1)}{(1+e^x)^2}$ **D** $\dfrac{e^x}{1+e^x}$

E $\dfrac{1+e^x}{e^{2x}}$ **F** $\dfrac{e^{2x}}{(1+e^x)^2}$ **G** $\dfrac{e^x}{(1+e^x)^2}$ **H** $\dfrac{(1+e^x)^2}{e^{2x}}$

Question 17

By first applying the Product Rule, choose the option that gives (correct to 2 decimal places) the maximum value of the function

$$f(x) = e^{x/3}\sin(2x)$$

on the interval $[0, \pi]$.

Options

A 0.70 **B** 0.78 **C** 0.95 **D** 1.27

E 1.32 **F** 1.47 **G** 2.22 **H** 2.44

Question 18

By using *either* equation (2.3) *or* equation (2.4) in *Chapter C2*, choose the option that gives an expression for the indefinite integral

$$\int \frac{4+x^2}{(12x+x^3)^2}\,dx.$$

In each option, c is an arbitrary constant.

Options

A $\ln\left(\dfrac{x}{12+x^2}\right)+c$ **B** $\ln\left(\dfrac{3x}{12+x^2}\right)+c$ **C** $\dfrac{x}{12+x^2}+c$

D $-\dfrac{3x}{12+x^2}+c$ **E** $\ln\big(x(12+x^2)\big)+c$ **F** $3\ln\big(x(12+x^2)\big)+c$

G $\dfrac{1}{x(12+x^2)}+c$ **H** $-\dfrac{1}{3x(12+x^2)}+c$

Question 19

Choose the option that gives (correct to 2 decimal places) the area of the region which lies between the lines $x = \frac{1}{12}\pi$ and $x = \frac{1}{4}\pi$, above the x-axis and below the graph of

$$y = 16\sin(2x)\,(1 - \sin(2x))\,.$$

Options

A 1.01 **B** 1.79 **C** 2.54 **D** 3.07

E 3.98 **F** 4.31 **G** 4.66 **H** 5.47

Question 20

Choose the option that gives the solution of the initial-value problem

$$\frac{dy}{dx} = -\sqrt{16y^3e^{4x}} \quad (y > 0), \qquad y = \tfrac{1}{4} \text{ when } x = 0.$$

Options

A $y = (e^{-2x} + 1)^{1/3}$ **B** $y = \dfrac{1}{(e^{2x} + 1)^2}$ **C** $y = \frac{1}{8}(e^x + e^{-x})$

D $y = e^{-4x} - \frac{3}{1}$ **E** $y = \dfrac{1}{2(e^x + e^{-x})}$ **F** $y = \frac{1}{16}(1 + e^x)^2$

G $y = \frac{1}{4}e^{-4x/3}$ **H** $y = \frac{1}{4} + (1 - e^x)^2$

Question 21

The mass m of a radioactive substance present at time t can be modelled by the equation $m = m_0e^{-kt}$, where m_0 is the initial mass of the substance, and k is a constant. After 100 years, four-fifths of the substance has decayed (and therefore one-fifth remains). Choose the option that gives (in years, to the nearest year) the half-life of the substance.

Options

A 23 **B** 27 **C** 31 **D** 35

E 39 **F** 43 **G** 47 **H** 51

Questions 22 to 28 are on Block D.

Question 22

Michael and Anna each choose at random an integer between 1 and 10, inclusive. Choose the option that gives the probability that the integers chosen add up to 5.

Options

A $\frac{1}{100}$ **B** $\frac{1}{50}$ **C** $\frac{1}{25}$ **D** $\frac{1}{10}$ **E** $\frac{1}{5}$ **F** $\frac{2}{5}$

Question 23

Nicholas Bernoulli suggested that the births of boys and girls could be modelled by rolling a die with 35 faces, 18 of which represent a boy and 17 represent a girl. Using this model, choose the option closest to the probability that a couple who continue to have children until they have a boy will have exactly five children.

Options

A	0.014	**B**	0.018	**C**	0.027
D	0.029	**E**	0.034	**F**	0.036

Questions 24 and 25

A company gives all its job applicants an aptitude test. The test is designed to take approximately 1 hour to complete. Experience suggests that the completion times have a mean of 62.4 minutes and a standard deviation of 7.2 minutes.

24 Choose the option that is closest to the standard error (in minutes) of the mean completion time of samples of 40 people taking the test.

Options for Question 24

A	0.03	**B**	0.07	**C**	0.18
D	0.42	**E**	1.14	**F**	1.30

You will need to use OUStats to answer Question 25.

25 The mean completion time of samples of 30 people taking the test has standard error 1.31. Choose the option that is closest to the probability that the mean completion time for a sample of 30 people taking the test will be greater than 1 hour.

Options for Question 25

A	0.034	**B**	0.372	**C**	0.628
D	0.967	**E**	0.982	**F**	1.000

Question 26

A survey of the amount spent on package holidays by a random sample of 65 customers of a travel agency shows that the average expenditure is £423 with a standard deviation of £115 (both values rounded to the nearest £). Choose the option that gives an approximate 95% confidence interval for the amount (to the nearest £) spent by all customers.

Options

A	(198, 648)	**B**	(395, 451)	**C**	(400, 446)
D	(409, 437)	**E**	(420, 426)	**F**	(421, 425)

Question 27

A study was carried out to determine the effect of position in a garden on the heights of sunflowers. The heights (in metres) of 58 sunflowers were measured. Thirty of the sunflowers were grown in a shady part of the garden, and the rest were grown in a sunny part. The mean height of the sunflowers grown in the shady part was 2.88 m with standard deviation 0.527 m, and the mean height of the sunflowers grown in the sunny part was 3.62 m with standard deviation 0.894 m. Choose the option that gives the estimated standard error (in metres) for the difference between the two sample mean sunflower heights for the two positions in the garden.

Options

A	0.038	**B**	0.049	**C**	0.194
D	0.222	**E**	0.265	**F**	0.711

Question 28

The gross weekly earnings in 1995 of 91 primary school teachers (37 male and 54 female) were recorded. The sample mean for the men was £443.80 with sample standard deviation £90.80, and the sample mean for the women was £394.90 with sample standard deviation £67.49. The estimated standard error of the difference between the gross weekly earnings of the samples of male and female primary school teachers was £17.53. Choose the option that is closest to the value of the test statistic z which would be used to carry out a two-sample z-test to test whether there was a difference in gross weekly earnings between male and female primary school teachers in 1995.

Options

A	0.16	**B**	0.97	**C**	1.40
D	2.71	**E**	2.79	**F**	11.68

Important information for TMA 04 and CMA 42

You are strongly advised to keep a copy of your work and to obtain evidence of posting. Without such evidence, an assignment that becomes lost in the post cannot be re-submitted. In addition, keep copies of, and obtain proof of posting for, any correspondence with The Open University concerning your assignments.

Late submissions

TMA 04 must reach your tutor and CMA 42 must reach The Open University by the cut-off dates given on the front page of this booklet. **Your tutor is not authorised to give permission for you to submit after the cut-off date.**

Assignments received after the cut-off date will not normally be assessed unless:

- you are able to prove that it was posted in sufficient time to arrive before the cut-off date; or
- you have had formal approval for a delayed submission from the University (see below).

Delayed submission of your final assignments

If you are unable to meet the cut-off dates for these last two assignments, exceptionally you may be eligible to delay submission until 31 January 2007. This applies **only** if very serious circumstances have arisen in the **final two- or three-week period** before the cut-off dates, such as prolonged illness, or the death or serious illness of a close relative. You are expected to work on these assignments for an extended period, not to leave them until the last few days before the cut-off dates. Therefore delayed submission will not normally be considered if the special circumstances occur only in the last week before a cut-off date.

If you wish to apply for delayed submission, you must write, before the cut-off date, to:

Head of Assessment, Credit and Awards
Assessment Policy Office
The Open University
P.O. Box 83
Walton Hall
Milton Keynes
MK7 6BF

Remember that your request must be received **before the cut-off date**. It will be acknowledged to confirm receipt. In your application you should include:

- the details of your circumstances;
- the timescale in which they have affected or are likely to affect your work;
- documentary evidence supporting your application (for example, a medical certificate).

If you require advice on your application, contact the Study Support Team at your Regional Centre.

You should not assume that delayed submission will be granted so, if it is possible, continue to work on your assignments while a decision is pending. If permission to delay submission is denied, submit whatever you have been able to complete by the cut-off date, and also send in a special circumstances PT39 form (see below). Similarly, if something happens to disrupt your study in the last few days before the cut-off date, you should submit what you have done and send in a PT39 form.

Special circumstances affecting your performance

The Examination and Assessment Board can give limited weight to information about special circumstances that have had a serious adverse effect on your performance in part of your assessment. The *Assessment Handbook* (available via your StudentHome web page) gives guidance regarding the sorts of circumstances that the University considers serious and those that it does not. Members of the Study Support Team, at your Regional Centre, will also be able to offer advice.

You should submit a special circumstances (PT39) form in the following situations.

- If you have applied for delayed submission for your final assignments and it has not been granted.
- If something happens to disrupt your study in the last few days before the cut-off dates of the final assignments.
- You have had special circumstances affecting your work on a particular assignment earlier in the course.

If you have a disability which you believe has seriously affected your assessment performance, you are strongly urged to submit a PT39 form. *Any information that you have given to the University for other purposes will not normally be brought to the attention of the Examination and Assessment Board* ***unless a PT39 form is submitted indicating that you feel that the disability has adversely affected your performance.***

The PT39 form can be obtained from the Study Support Team at your Regional Centre. It should be completed and returned there, together with supporting documentary evidence, to arrive **no later than 14 days after the cut-off date for TMA 04**. Your tutor cannot submit this information on your behalf.

Special circumstances information received after the deadline given above will not normally be taken into account unless there is good evidence to show that you were unable to notify the University in time. It is your responsibility to make sure that the information reaches the University by the appropriate date. In particular, if in the run up to the last assignments you feel that you are not going to be able to complete TMA 04, then you should ask for delayed submission in advance rather than submit special circumstances information.

Course results

Notification of course results will be sent out in late December.

If you have not received your result by mid-January, please write to the address given below under the heading 'Queries and appeals'.

Please do not ask your Regional Centre, your tutor or the Course Team about your result.

Information about results cannot be given over the telephone, or by e-mail.

After course results have been sent out by post, you will be able to find your result in your Student Record on the University's website: `www.open.ac.uk/students`

You are advised to ensure that you are able to log on to view your Student Record before the issue of course results. Detailed on-screen help is provided.

The pass mark for the course will normally be set at about 40%, and you must also achieve a score of at least 30% on TMA 04. Your overall score will be the weighted mean of your scores for all the TMAs and CMAs, as described in the *Course Guide*.

Under University policy, the Examination and Assessment Board can adjust the assignment scores given by your tutor. This adjustment can be in either direction, up or down, if your tutor was considered to mark harshly or leniently relative to the mark schemes. Under University policy, adjustments do not normally exceed 15%.

Re-submission

If the weighted average of your assignment scores is 40% or more, and your score on TMA 04 does not meet the threshold of 30% but is at least 15%, then you will be entitled to re-submit TMA 04. You will be notified of this entitlement with your course result, and you will be required to re-submit TMA 04 by 31 January 2007.

If you achieve less than 15% on TMA 04, or less than 30% after a re-submission, or you do not submit it, and do not have permission for delayed submission, then you will be given a fail result and will not be entitled to re-submit.

Feedback on performance

Your TMA 04 will be retained at Walton Hall for the MST121 Examination and Assessment Board meeting. It will be returned to you after all course results have been determined. You should expect to receive your TMA 04 back and also feedback on CMA 42 from the University in February/March.

Pending results

Each year the Examination and Assessment Board is unable to come to a decision about the course results of a few students, who are given a 'pending' result. There are various reasons why you may be given such a result. The Board may want you to attend a *viva voce* examination in person. You would be told about this separately. Alternatively, a TMA score or some other information might be missing from your assessment record. In such a case, your final result will be sent to you as soon as possible.

Queries and appeals

If you want to query your course result, please read carefully the sections in the *Assessment Handbook* about how course results are awarded, result queries and formal appeals to the University. You should write, within four weeks of receiving your result, to:

Head of Examinations and Assessment
Examinations Office
The Open University
P.O. Box 720
Walton Hall
Milton Keynes
MK7 6ZQ

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